

Table 18-1: Independent Parameters Used in the Receptor Model

Chemical Class	Chemical Name
Metals	Copper
	Chromium
	Lead
	Mercury
PCDD/F	2,3,7,8-TCDD
	Total TCDD
Pesticides	4,4' -DDE
	Chlordane, gamma
PAH	Benzo[a]pyrene
	Fluoranthene
PCB	Total PCB
Other Parameters	Iron
	Total Organic Carbon

Table 18-2: Estimated Solids Load and Watershed Area to the Lower Passaic River

Source to the Lower Passaic River	Solids Load ^a (cubic yards/year)	Watershed Area (square miles)
Dundee Dam	73,000	810
Saddle River	4,100	60
Third River	850	13
Second River	990	15
CSOs (ungauged)	1600	25
SWOs (ungauged)	1200	18

a: Solids loads differ from the values reported in the CSM because adjustments were made here to consider the additional watershed area between the USGS gauging station and the confluence with the Lower Passaic River.

Values were rounded to two significant figures.

Table 18-5: Unique Contaminants Considered for the Model

Analyte	Dundee Dam Concentrations
Metals	Arsenic
	Cadmium
	Chromium
	Cobalt
	Copper
	Lead
	Mercury
	Nickel
	Zinc
Pesticides	Trans-Chlordane
	DDE
PCDD/F	2,3,7,8-TCDD
	Total TCDD
PCB	Total PCB
PAH Compounds	Benz[a]anthracene
	Benzo[a]pyrene
	Chrysene
	Fluoranthene
	Indeno[1,2,3-cd]pyrene
	Pyrene
Other Parameters	Iron
	Total Organic Carbon (TOC)

Table 18-6: Independent Parameters Directly Optimized in the Receptor Model

Chemical Class	Chemical Name
Metals	Chromium
	Copper
	Lead
	Mercury
PCDD/F	2,3,7,8-TCDD
	Total TCDD
Pesticides	Chlordane, gamma
	DDE
PAH	Benzo[a]pyrene
	Fluoranthene
PCB Congeners and Co-Elutions	Total PCB
Other Parameters	Iron
	Total Organic Carbon (TOC)

Table 18-9

Analyte	Average Northern Concentration ^b	Average Southern Concentration ^c
Arsenic (mg/kg)	10	10
Cadmium (mg/kg)	1.2	.63
Chromium (mg/kg)	110	67
Cobalt (mg/kg)	9.9	10
Copper (mg/kg)	120	82
Lead (mg/kg)	110	77
Mercury (mg/kg)	2.2	0.93
Nickel (mg/kg)	34	33
Zinc (mg/kg)	220	160
Trans-Chlordane (µg/kg) ^a	3.8	3.8
DDE (µg/kg)	32	14
2,3,7,8-TCDD (ng/kg)	77	23
Total TCDD (ng/kg)	160	65
Total PCB (ug/kg)	570	260
Benz[a]anthracene (mg/kg)	1.5	0.44
Benzo[a]pyrene (mg/kg)	1.9	0.47
Chrysene (mg/kg)	1.6	0.44
Fluoranthene (mg/kg)	2.4	0.60
Indeno[1,2,3-cd]pyrene (mg/kg)	1.0	0.32
Pyrene (mg/kg)	2.9	0.65
TOC (%)	2.1	1.7

a. Newark Bay samples from the 2005 sampling event were reported non-detect for chlordane. The value used here is from Robinson, 2002.

b. The six samples used to delineate the northern Newark Bay end member were NB01SED46, NB01SED47, NB01SED52, NB01SED52 (dup), NB01SED55 and NB01SED61

c. The five samples used to delineate the southern Newark Bay end member were NB01SED017, NB01SED021, NB01SED024, NB01SED030 and NB01SED031

Table 18-10: Upper Passaic River Recently Deposited Surface Sediment Concentrations for Select Contaminants

Analyte	Upper Passaic River Concentrations
Arsenic (mg/kg)	2.9
Cadmium (mg/kg)	1.5
Chromium (mg/kg)	31
Cobalt (mg/kg)	8.8
Copper (mg/kg)	63
Lead (mg/kg)	130
Mercury (mg/kg)	0.72
Nickel (mg/kg)	19
Zinc (mg/kg)	290
Trans-Chlordane (µg/kg)	23
DDE (µg/kg)	13
2,3,7,8-TCDD (ng/kg)	1.9
Total TCDD (ng/kg)	44
Total PCB (ug/kg)	460
Benz[a]anthracene (mg/kg)	4.7
Benzo[a]pyrene (mg/kg)	5.6
Chrysene (mg/kg)	6.4
Fluoranthene (mg/kg)	9.1
Indeno[1,2,3-cd]pyrene (mg/kg)	3.5
Pyrene (mg/kg)	9.1
TOC (%)	3.7

Concentrations rounded to two significant figures, whenever possible.

Table 18-11: Tributary Average Concentrations for Select Contaminants

Analyte	Saddle River	Third River	Second River
Arsenic (mg/kg)	3.6	5.7	11
Cadmium (mg/kg)	0.41	1.4	1.3
Chromium (mg/kg)	20	35	47
Cobalt (mg/kg)	4.4	5.7	8.9
Copper (mg/kg)	43	68	160
Lead (mg/kg)	57	150	320
Mercury (mg/kg)	0.10	0.48	0.49
Nickel (mg/kg)	10	20	31
Zinc (mg/kg)	150	260	450
Trans-Chlordane (µg/kg)	63	79	150
DDE (µg/kg)	21	48	180
2,3,7,8-TCDD (ng/kg)	2.9	2.0	4.0
Total TCDD (ng/kg)	25	24	48
Total PCB	480	190	340
Benz[a]anthracene (mg/kg)	2.8	3.4	6.7
Benzo[a]pyrene (mg/kg)	3.7	4.3	9.4
Chrysene (mg/kg)	4.6	5.6	12
Fluoranthene (mg/kg)	8.7	9.5	19
Indeno[1,2,3-cd]pyrene (mg/kg)	2.8	3.3	7.7
Pyrene (mg/kg)	7.3	8.0	77
TOC (%)	4.1	5.5	11

Concentrations rounded to two significant figures, whenever possible

Table 18-12: Average CSO Concentrations for Select Contaminants

Analyte	Average CSO Concentrations
Arsenic (mg/kg)	3.0
Cadmium (mg/kg)	2.1
Chromium (mg/kg)	61
Cobalt (mg/kg)	10
Copper (mg/kg)	290
Lead (mg/kg)	400
Mercury (mg/kg)	1.0
Nickel (mg/kg)	36
Zinc (mg/kg)	860
Trans-Chlordane (µg/kg)	36
DDE (µg/kg)	27
2,3,7,8-TCDD (ng/kg)	3.1
Total TCDD (ng/kg)	150
Total PCB (ug/kg)	310
Benz[a]anthracene (mg/kg)	2.1
Benzo[a]pyrene (mg/kg)	2.6
Chrysene (mg/kg)	4.2
Fluoranthene (mg/kg)	6.7
Indeno[1,2,3-cd]pyrene (mg/kg)	2.4
Pyrene (mg/kg)	5.7
TOC (%)	26

Concentrations rounded to two significant figures.

Table 18-13: Average Lower Passaic River Surface Sediment Concentrations for Select Contaminants

Analyte	Average Mainstem (RM2 – RM12)Concentration
Arsenic (mg/kg)	8.0
Cadmium (mg/kg)	3.6
Chromium (mg/kg)	110
Cobalt (mg/kg)	8.6
Copper (mg/kg)	160
Lead (mg/kg)	210
Mercury (mg/kg)	1.9
Nickel (mg/kg)	32
Zinc (mg/kg)	490
Trans-Chlordane (µg/kg)	36
DDE (µg/kg)	52
2,3,7,8-TCDD (ng/kg)	370
Total TCDD (ng/kg)	530
Total PCB (ug/kg)	1200
Benz[a]anthracene (mg/kg)	2.8
Benzo[a]pyrene (mg/kg)	3.6
Chrysene (mg/kg)	4.1
Fluoranthene (mg/kg)	5.9
Indeno[1,2,3-cd]pyrene (mg/kg)	2.5
Pyrene (mg/kg)	5.8
TOC (%)	6.3

Concentrations rounded to two significant figures, whenever possible.

Table 19-1: Contaminant Burden Attributed to Resuspension

Analyte	Percent of Contaminant Burden in Recently Deposited Sediments Attributed to Resuspension
Chromium	≈ 66
Copper	≈ 68
Lead	≈ 70
Mercury	≈ 67
Chlordane	≈ 53
DDE	≈ 67
2,3,7,8-TCDD	≈ 95
Total TCDD	≈ 89
Total PCB	≈ 69
Benzo[a]pyrene ^a	≈ 46
Fluoranthene ^a	≈ 55
Iron	≈ 49
TOC	≈ 75

a. These percentages are based on the non-iron-normalized model result.

Table 21-1: Estimated Mass Balance for Solids for Newark Bay

Source of Solids	Lowe <i>et al.</i> Mass Balance (cubic yards)	Estimated Mass Balance (cubic yards) ^a
Passaic River	79,100 ^b	12,400
Hackensack River	6,460	6,460
Combined Sewer/Water Treatment	10,500	10,500
Atmospheric Deposition	285	285
Kill van Kull	205,000	260,000
Arthur Kill	41,900	53,200

a: Based on Lowe *et al.* (2005); Balance is based on a correction for deposition in the Lower Passaic River.

b: The delivery of solids from the Upper Passaic is estimated by the Comprehensive Conceptual Site Model to be about 55,000 cy (Refer to Chapter 18).

Table 21-2: Surface Concentrations Used in the Initial Mass Balances for Newark Bay

Source	2,3,7,8-TCDD Concentration (µg/kg) ^{a,b}	Total TCDD Concentration (µg/kg) ^{a,b}	Ratio of 2,3,7,8-TCDD to Total TCDD (unitless)	Mercury Concentration (mg/kg) ^{a,b}
Passaic River (RM 1 to 7)	0.54 (N = 255)	0.68 (N = 255)	0.8	3.4 (N=104)
Mouth of Hackensack River	0.093 (N = 5)	0.14 (N = 5)	0.67	4.0 (N=5)
CSO/WWTP ^c	UK ^d	UK	UK	UK
Atmospheric Deposition	UK	UK	UK	UK
Kill van Kull	0.01 ^e	0.07 ^e	0.15	1.1 (N=5)
Arthur Kill	0.05	0.18	0.28	1.6 (N=4)
Newark Bay	0.076 (N = 32)	0.16 (N = 32)	0.56	2.4 (N=48)

a: Average (sample size)

b: Concentrations represent average surface sediment concentrations from 1991 to 1995, unless otherwise noted.

c: CSO = Combined sewage overflow; WWTP = Waste water treatment plant

d: UK = unknown value.

e: Concentration represents New York harbor sediments from dated sediment cores at the entry to Kill van Kull 1994-1998 (Chaky, 2003).

Table 21-3: Updated Mass Balance for Solids for Newark Bay

Source of Solids	Lowe <i>et al.</i> Mass Balance (cubic yards) ^a	Estimated Mass Balance - Solids Only (cubic yards) ^a	Estimated Mass Balance - Chemistry and Solids (cubic yards)
Passaic River	79,100	12,400	32,500
Hackensack River	6,460	6,460	6,460
Combined Sewer/Water Treatment	10,500	10,500	10,500
Atmospheric Deposition	285	285	285
Kill van Kull	205,000	260,000	243,000
Arthur Kill	41,900	53,200	50,000

a: From Table 21-1

Table 21-4: Initial 2,3,7,8-TCDD Mass Balance for Newark Bay

Source	Solids Mass Balance ^a		2,3,7,8-TCDD Concentration	2,3,7,8-TCDD Annual Load	Total TCDD Concentration	Total TCDD Annual Load	Ratio of 2,3,7,8-TCDD to Total TCDD
	cubic yard/year	Metric-ton/year	(µg/kg) ^b	(g/year)	(µg/kg) ^b	(g/year)	(unitless)
Passaic River (RM 1 to 7)	35,600	21,200	0.54	12	0.68	14	0.8
Mouth of Hackensack River	6,460	3,870	0.093	0.36	0.14	0.54	0.67
CSO/WWTP ^c	10,500	6,300	UK ^d	UK	UK	UK	UK
Atmospheric Deposition	285	170	UK	UK	UK	UK	UK
Kill van Kull	241,000	116,000	0.01 ^e	1.16	0.07	7.7	0.15
Arthur Kill	49,300	23,700	0.05	1.19	0.18	4.2	0.28
Total	343,000	171,000		14		26	
Newark Bay Calculated			0.083		0.15		0.53
Newark Bay Measured			0.076		0.16		0.56
Total Annual Load	343,000 cubic yard/year			14 g/year		26 g/year	

a: Solids mass balance based on Lowe, *et al.* (2005) with several adjustments made to satisfy the chemical mass balance (Section 4.6.1). Conversion of sediment volume to sediment mass as given by Lowe, *et al.* (2005).

b: Concentrations represent average surface sediment concentrations for 1991 to 1995 sediments, unless otherwise noted.

c: CSO = Combined sewage overflow; WWTP = Waste water treatment plant

d: UK = unknown value. Mass fluxes for sources within unknown values were set to zero for the chemical mass balance.

e. Concentration represents mean New York harbor sediments at the entry to Kill van Kull 1994-1998 (Chaky, 2003).

Table 21-5: Updated 2,3,7,8-TCDD Mass Balance for Newark Bay

Source	Solids Mass Balance ^a		2,3,7,8-TCDD Concentration	2,3,7,8-TCDD Annual Load	Total TCDD Concentration	Total TCDD Annual Load	Ratio of 2,3,7,8-TCDD to Total TCDD
	cubic yard/year	Metric-ton/year	(µg/kg) ^{b,c}	(g/year)	(µg/kg) ^{b,c}	(g/year)	(unitless)
Passaic River (RM 1 to 12)	32,400	19,000	0.3	5.8	0.46	8.93	0.65
Mouth of Hackensack River	6,500	3,900	0.093	0.36	0.14	0.54	0.67
CSO/WWTP ^d	10,500	6,300	0.0031	0.02	0.06	0.39	0.05
Atmospheric Deposition	285	170	UK ^e	UK	UK	UK	UK
Kill van Kull	243,000	118,000	0.01 ^f	1.17	0.07	8.39	0.14
Arthur Kill	50,000	24,000	0.05	1.20	0.18	4.3	0.28
Total	343,000	171,000		8.56		22.5	
Newark Bay Calculated			0.050		0.13		0.38
Newark Bay Measured			0.050		0.11		0.28
Total Annual Load	342,785 cubic yard/year			8.56 g/year		22.5 g/year	

a: Solids mass balance based on Lowe, *et al.* (2005) with several adjustments made to satisfy the chemical mass balance. Conversion of sediment volume to sediment mass as given by Lowe, *et al.* (2005).

b: Concentrations for the mouth of Hackensack River, Kill van Kull, and Arthur Kill represent average surface sediment concentrations for 1991 to 1995 sediments, unless otherwise noted.

c: Concentrations for the Passaic River and CSOs/SWOs represent average surface sediment and suspended solids concentrations from the 2007-2008 sampling event; measured Newark Bay concentrations represent average surface sediment concentrations for 2005 sediments.

d: CSO = Combined sewage overflow; WWTP = Waste water treatment plant

e: UK = unknown value. Mass fluxes for sources within unknown values were set to zero for the chemical mass balance.

f: Concentration represents mean New York harbor sediments at the entry to Kill van Kull 1994-1998 (Chaky, 2003).

Table 21-6: Initial Mercury Mass Balance for Newark Bay

Source	Solids Mass Balance ^a		Mercury Concentration	Mercury Annual Load
	Cubic yard/year	Metric-ton/year	(mg/kg) ^b	(g/year)
Passaic River (RM 1 to 7)	35,600	21,200	3.4	73,000
Mouth of Hackensack River	6,460	3,870	4.0	16,000
CSO/WWTP ^c	10,500	6,300	UK ^d	UK
Atmospheric Deposition	285	170	UK	UK
Kill van Kull	241,000	116,000	1.1	132,000
Arthur Kill	49,300	23,700	1.6	38,000
Total	343,000	171,000		259,000
Newark Bay Calculated			1.5	
Missing Mercury Source				150,000
New Newark Bay Calculated			2.4	
Newark Bay Measured			2.4	
Net Annual Load				409,000 g/year

a: Solids mass balance based on Lowe, *et al.* (2005) with several adjustments made to satisfy the chemical mass balance. See text for discussion. Conversion of sediment volume to sediment mass as given by Loewe, *et al.*, 2005.

b: Mercury concentrations represent average surface sediment concentrations for 1991 to 1995 sediments.

c: CSO = Combined sewage overflow; WWTP = Waste water treatment plant

d: UK = unknown value. Mass fluxes for sources within unknown values were set to zero for the chemical mass balance.

Table 21-7: Updated Mercury Mass Balance for Newark Bay

Source	Solids Mass Balance ^a		Mercury Concentration	Mercury Annual Load
	Cubic yard/year	Metric-ton/year	(mg/kg) ^{b,c}	(g/year)
Passaic River (RM 1 to 12)	32,400	19,300	1.9	37,000
Mouth of Hackensack River	6,500	3,900	4.0	15,000
CSO/WWTP ^d	10,500	6,300	1.0	6,300
Atmospheric Deposition	285	170	UK ^e	UK
Kill van Kull	243,000	117,500	1.1	134,000
Arthur Kill	50,000	24,000	1.6	39,000
Total	343,000	171,000		232,000
Newark Bay Calculated			1.35	
Missing Mercury Source				None ^f
Newark Bay Measured			1.37	
Net Annual Load				235,000 g/year

a: Solids mass balance based on Lowe, *et al.* (2005) with several adjustments made to satisfy the chemical mass balance. See text for discussion. Conversion of sediment volume to sediment mass as given by Loewe, *et al.*, 2005.

b: Mercury concentrations for the Mouth of Hackensack River, Kill van Kull, and Arthur Kill represent average surface sediment concentrations for 1991 to 1995 sediments.

c: Mercury concentrations for the Passaic River and CSO/SSO represent average surface sediment concentrations for 2007 sediments; measured mercury concentrations for Newark Bay represent average surface sediment concentrations for 2005 sediments.

d: CSO = Combined sewage overflow; WWTP = Waste water treatment plant

e: UK = unknown value. Mass fluxes for sources within unknown values were set to zero for the chemical mass balance.

f: The differences between the calculated load and the estimated of the measured load is within the precision of the calculations.

Table 21-8: Summary of Initial vs. Revised Mass Balance Results

Source	Initial Solids (percent)	Revised Solids (percent)	Initial 2,3,7,8-TCDD (percent)	Revised 2,3,7,8-TCDD (percent)	Initial Mercury (percent)	Revised Mercury (percent)
Passaic River (RM 1 to 12)	10	11	80	68	20	16
Mouth of Hackensack River	2	2	3	4	4	7
CSO/WWTP	3	4	UK ^a	0.2	UK ^a	3
Atmospheric Deposition	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Kill van Kull	70	69	8	14	30	57
Arthur Kill	15	14	8	14	9	16
“Missing” Mercury	NA ^b	NA ^b	NA ^b	NA ^b	35	1
Total ^c	100	100	~100	~100	~100	~100

a: Contaminant concentrations on CSO and WWTP loads for the Lower Passaic River were not available for the chemical mass balance calculations. However, measurements on Newtown Creek discharges would suggest that the contribution for 2,3,7,8-TCDD is minor (Chaky, 2003) and on the order of the contributions by the Hackensack River.

b: Not applicable to solids and 2,3,7,8-TCDD mass balances.

c: Columns do not sum to exactly 100 percent in all cases due to rounding. Percent contributions were rounded to nearest increment of 5 percent for contributions greater than 10 percent.

Table 22-1: 2,3,7,8-TCDD and mercury tissue-sediment ratio values for blue crab, mummichog and white perch in 1995, 1999 and 2000 datasets.

Species	Year	2,3,7,8-TCDD			Mercury		
		Tissue-Sediment Ratio Values	Standard Error	Sample Size ^a & Tissue Type(s) ^b	Tissue-Sediment Ratio Values	Standard Error	Sample Size & Tissue Type(s)
Blue Crab	1995	0.25	0.18	6 Tissue	0.043	0.009	6 Tissue
	1999	0.13	0.037	56 Tissue	0.023	0.002	65 Tissue
	2000	0.07	0.027	7 Tissue	0.032	0.004	7 Tissue
	All Points	0.13	0.039	69 Tissue	0.026	0.002	78 Tissue
Mummichog	1995	0.06	0.021	5 Tissue	0.026	0.010	3 Tissue
	1999	0.10	0.035	51 Tissue	0.010	0.001	51 Tissue
	2000	0.06	0.019	6 Tissue	0.013	0.006	6 Tissue
	All Points	0.09	0.031	62 Tissue	0.011	0.001	60 Tissue
White Perch	1995	n/a	n/a	n/a	n/a	n/a	n/a
	1999	0.29	0.076	21 Tissue	0.071	0.005	29 Tissue
	2000	0.20	0.055	25 Tissue	0.109	0.009	35 Tissue
	All Points	0.25	0.065	46 Tissue	0.092	0.007	64 Tissue

Notes:

a) Sample size is the number of tissue samples used to calculate the average tissue concentration.

b) Tissue type is the tissue matrix that was analyzed (e.g., tissue, muscle).

Table 22-2: Average 2,3,7,8-TCDD and mercury tissue concentrations for blue crab, mummichog, and white perch.

Year	Species	Lipid Values (g/g)	2,3,7,8-TCDD			Mercury		
			Average Tissue Conc. (ppb)	Standard Error	Sample Size	Average Tissue Conc. ^b (ppb)	Standard Error	Sample Size
1995	Blue Crab	0.00077	0.199	0.137	6	138	28.9	6
1999			0.103	0.014	56	75	3.2	65
2000			0.054	0.017	7	102	10.6	7
All Points			0.106	0.016	69	83	3.7	78
1995	Mummichog	0.00023	0.053	0.010	5	83	33.3	3
1999			0.082	0.019	51	33	1.3	51
2000			0.045	0.010	6	42	17.7	6
All Points			0.076	0.016	62	37	2.4	60
1995	White Perch	0.0404	n/a	n/a	n/a	n/a	n/a	n/a
1999			0.238	0.008	21	231	4.5	29
2000			0.166	0.014	25	353	20.3	35
All Points			0.199	0.014	46	298	15.3	64

Table 22-3: Average and TOC-normalized surface sediment concentrations for 2,3,7,8-TCDD and mercury for samples collected in 1995 Passaic River Remedial Investigation sampling program.

Description	Average Sediment Conc. (ng/g)	Standard Error	Sample Size
2,3,7,8-TCDD	0.8116	0.208	95
Mercury	3229	198.2	95
	Avg. TOC Normalized Sediment Conc. (ug/kg)	Standard Error	Sample Size
2,3,7,8-TCDD	10.7	3.28	63
Mercury	41,403	4,427	89

Table 22-4: 2,3,7,8-TCDD and mercury BSAF values for blue crab, mummichog, and white perch for the 1995, 1999 and 2000 datasets.

Species	Year	2,3,7,8-TCDD			Mercury		
		BSAF Values ^b	Standard Error	Sample Size & Tissue Type(s)	BSAF Values	Standard Error	Sample Size & Tissue Type(s)
Blue Crab	1995	24	18.2	6 Tissue	4.3	1.0	6 Tissue
	1999	12	4.2	56 Tissue	2.4	0.27	65 Tissue
	2000	6.6	2.9	7 Tissue	3.2	0.48	7 Tissue
	All Points	13	4.4	69 Tissue	2.6	0.30	72 Tissue
Mummichog	1995	22	7.8	5 Tissue	8.9	3.7	3 Tissue
	1999	34	13.0	51 Tissue	3.6	0.41	51 Tissue
	2000	19	7.1	6 Tissue	4.5	2.0	6 Tissue
	All Points	32	11.7	62 Tissue	3.9	0.49	57 Tissue
White Perch	1995	n/a	n/a	n/a	n/a	n/a	n/a
	1999	0.55	0.17	21 Tissue	0.138	0.015	29 Tissue
	2000	0.38	0.12	25 Tissue	0.21	0.026	35 Tissue
	All Points	0.46	0.14	46 Tissue	0.18	0.021	64 Tissue